CLAIMS

1. A titanium oxide structure having an optical band gap (hereinafter referred to as "BG") of 2.7 to 3.1 eV as calculated from absorbance measured by an integrating sphere-type spectrophotometer and having a tap density of 0.15 to 0.45 g/cm^3.

2. A metal oxide structure obtained by dry-mixing a plurality of metal oxide powder particles differing in the particle size, wherein assuming that an optical band gap (hereinafter referred to as "BG") of raw material metal oxide is BG0 and the BG of metal oxide after the dry mixing is BG1, the (BG0 - BG1) is from 0.01 to 0.45 eV.

3. A method for producing a metal oxide structure, comprising dry-mixing a metal oxide, wherein assuming that an optical band gap (hereinafter referred to as "BG") of raw material metal oxide is BG0 and the BG of metal oxide after the dry mixing is BG1, the mixing is performed to give a (BG0 - BG1) of 0.01 to 0.45 eV.

4. The method for producing a metal oxide structure as claimed in claim 3, wherein the dry mixing is at least one method selected from a ball mill, a high-speed rotary grinder, a stirring mill and a jet grinder.

5. The method for producing a metal oxide structure as claimed in claim 3, wherein the dry mixing is performed by a ball mill and assuming that the total mass of powder particles mixed is wp (g), the mass of medium is wm (g), the inner diameter of ball mill container is d (m), the rotation number is n (rpm) and the mixing time is t (minute), the energy constant k1 at the dry mixing represented by the following relationship:

$$k1 = wm/wp \times d \times n \times t$$

is from 3,000 to 250,000.

6. The method for producing a metal oxide structure as claimed in claim 5, wherein the energy constant k1 is from 10,000 to 150,000.

7. The method for producing a metal oxide

structure as claimed in claim 5, wherein the energy constant k1 is from 10,000 to 50,000.

8. The method for producing a metal oxide structure as claimed in any one of claims 3 to 7, wherein the raw material metal oxide comprises a metal oxide powder having an average primary particle size of 100 to 500 nm (hereinafter referred to as Particle Group A) and a metal oxide powder having an average primary particle size of 10 to 40 nm (hereinafter referred to as Particle Group B), the partial sizes being as converted from the specific surface area determined by the BET method.

9. The method for producing a metal oxide structure as claimed in claim 8, wherein Particle Group B is a mixture of a metal oxide powder having an average primary particle size of 20 to 40 nm (hereinafter referred to as Particle Group C) and a metal oxide powder having an average primary particle size of 10 to 20 nm (hereinafter referred to as Particle Group D), the particle sizes being as converted from the specific surface area determined by the BET method.

10. The method for producing a metal oxide structure as claimed in claim 8 or 9, wherein the average specific surface area of Particle Group B is from 60 to 110 m^2/g.

11. The method for producing a metal oxide structure as claimed in any one of claims 8 to 10, wherein at least one of Particle Groups A to D is a metal oxide synthesized by a gas phase process.

12. The method for producing a metal oxide structure as claimed in any one of claims 3 to 11, wherein the tap density is from 0.15 to 1.0 g/cm^3.

13. The method for producing a metal oxide structure as claimed in any one of claims 3 to 12, wherein the metal oxide is titanium oxide.

14. The method for producing a metal oxide structure as claimed in any one of claims 3 to 12, wherein the metal oxide is a mixture of titanium oxide

and at least one metal oxide selected from zinc oxide, niobium oxide, tantalum oxide, zirconium oxide, tin oxide and tungsten oxide.

15. The method for producing a metal oxide structure as claimed in claim 14, wherein the content of titanium oxide contained in said metal oxide mixture is 10 mass% or more.

16. A method for producing a metal oxide dispersion, comprising adding a dispersion medium to the titanium oxide structure claimed in claim 1, the metal oxide structure claimed in claim 2 or a metal oxide structure obtained by the production method claimed in any one of claims 3 to 15, and wet-mixing these by a ball mill, wherein assuming that the total mass of powder particles mixed is wp (g), the mass of medium is wm (g), the inner diameter of ball mill container is d (m), the rotation number is n (rpm) and the mixing time is t (minute), the energy constant k2 at the wet mixing is represented by the following relationship:

$$k2 = wm/wp \times d \times n \times t$$

and the energy constant k1 at the dry mixing satisfy the following relationship:

$$k2 \geq k1.$$

17. The method for producing a metal oxide dispersion as claimed in claim 16, wherein the energy constant k2 at the wet mixing and the energy constant k1 at the dry mixing satisfy the following relationship:

$$8.0 \times k1 \geq k2 \geq 1.5 \times k1.$$

18. The method for producing a metal oxide dispersion as claimed in claim 16, wherein the energy constant k2 at the wet mixing and the energy constant k1 at the dry mixing satisfy the following relationship:

$$5.0 \times k1 \geq k2 \geq 2.5 \times k1.$$

19. A titanium oxide-containing metal oxide dispersion obtained by the production method described in any one of claims 16 to 18.

20. A composition comprising the titanium oxide structure claimed in claim 1, the metal oxide structure claimed in claim 2, a metal oxide structure obtained by the production method claimed in any one of claims 3 to 15, or the titanium oxide-containing metal oxide dispersion claimed in claim 19.

21. A thin film comprising the titanium oxide structure claimed in claim 1, the metal oxide structure claimed in claim 2, a metal oxide structure obtained by the production method claimed in any one of claims 3 to 15, or the titanium oxide-containing metal oxide dispersion claimed in claim 19.

22. The metal oxide structure-containing thin film as claimed in claim 21, wherein the film has a thickness of from 1 to 40 μm.

23. A method for producing a dye sensitized solar cell, comprising including the metal oxide structure obtained by the production thereof claimed in any one of claims 3 to 15 as a dye sensitized electrode.

24. A method for producing a dye sensitized solar cell, comprising including the metal oxide structure obtained by the production method claimed in any one of claims 3 to 15 and the metal oxide dispersion claimed in any one of claims 17 to 19 as a dye sensitized electrode.

25. A dye sensitized solar cell produced by the production method claimed in claim 23 or claim 24.

26. A dye sensitized solar cell equipped with a dye electrode comprising, as a constituent member, the metal oxide structure-containing thin film claimed in claim 22.

27. A dye sensitized solar cell, wherein an optical band gap (hereinafter referred to as "BG") of titanium oxide after removing the dye from the dye electrode is from 2.7 to 3.1 eV.

28. An article having a power-generating function, equipped with the dye sensitized solar cell claimed in any one of claims 25 to 27.

29. An article having a light-emitting function,

equipped with the dye sensitized solar cell claimed in any one of claims 25 to 27.

30. An article having a heat-generating function, equipped with the dye sensitized solar cell claimed in any one of claims 25 to 27.

31. An article having a sound-generating function, equipped with the dye sensitized solar cell claimed in any one of claims 25 to 27.

32. An article having a moving function, equipped with the dye sensitized solar cell claimed in any one of claims 25 to 27.